

# Certificate of Calibration

Certificate Number: **654418**



**JJ Calibrations, Inc.**

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Portland, OR 97267-2105  
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**Liberty Electric**  
11774 SE Jennifer St  
Clackamas, OR 97015

PO: **3369-14072017**

Order Date: **07/14/2017**

Authorized By: **N/A**

Property #: **E033**

User: **N/A**

Department: **N/A**

Make: **Fluke**

Model: **1507**

Serial #: **22590033**

Description: **Insulation Tester**

Procedure: **403472**

Accuracy: **Refer to Mfg. Specs.**

Calibrated on: **07/20/2017**

\*Recommended Due: **07/20/2018**

Environment: **21 °C 51 % RH**

As Received: **Within Tolerance**

As Returned: **Within Tolerance**

Action Taken: **Calibrated**

Technician: **39**

Remarks: \* Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit.

Returned with probes, cover, and case.

## Standards Used

<u>Std ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Nomenclature</u>	<u>Due Date</u>	<u>Trace ID</u>
711A	JJ Calibrations	HV Resistance Box	High Voltage Resistance Box	08/24/2017	629126
702A	Fluke	5522A	Calibrator	01/30/2018	641137
749A	Fluke	87- V	Multimeter, Handheld	03/30/2018	645924
720A	IET	HARS-X-11-0.001	High Accuracy Resistance	11/03/2017	631360

JJ Calibrations, Inc. certifies that this instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual with the stated procedure using standards that are traceable to the National Institute of Standards and Technology (NIST), or other National Measurement Institutes (NMI's), or by using natural physical constants, intrinsic standards or ratio calibration techniques. The quality system and this certificate are in compliance with ANSI/NC SL Z540-1-1994, ISO/IEC 17025-2005, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. Unless otherwise stated, a test accuracy ratio (TAR) of 4:1, if achievable, is maintained. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without prior written consent of JJ Calibrations, Inc.  
JJ Calibrations, Inc. quality system has been assessed and accredited to ISO/IEC 17025:2005.

Reviewer

Issued 07/20/2017

Rev # 15

Inspector

# S & C DISTRIBUTION COMPANY

7225 Duvan Drive  
Tinley Park, IL 60477  
(708) 444-4908

## Certificate of Calibration

**Manufacturer:** S&C Distribution Company

**Model:** 330-5

**Description:** Relay Slide

**Serial Number:** 319980

The S & C Distribution Company, certifies that the instrument identified above was calibrated in accordance with applicable procedures. The calibration process is ISO-9001 compliant and is designed to certify that the instrument was within its published specifications at the time of calibration.

The measurement standards and instruments used during the calibration of this instrument are traceable to the United States National Institute of Standards and Technology (NIST), natural physical constants, consensus standards, or by ratio type measurements.

### CALIBRATION INFORMATION

**Cal Date:** 6-21-17 **Temperature** 71F

**Next Cal Due:** 6-20-18 **Humidity:** 48%

**Cal By:** [REDACTED] **Report Number:** 61456

**Cal Procedure:** 2 spec **Condition Received:** Cal.

**Test Station:** T.P., IL **Condition Returned:** Cal.

**END OF REPORT**

## Certificate of Calibration

### Beaverton Service Center

<b>Certificate Number:</b> BVL406677		
<b>Data Type:</b> Found-Left		<b>Calibration Date:</b> 15-Dec-2017
<b>Result Summary:</b> In Tolerance		<b>Calibration Due:</b> 15-Dec-2018
<b>Manufacturer:</b> Fluke		<b>Certificate Date:</b> 15-Dec-2017
<b>Model:</b> 287		<b>Temperature:</b> 23.5 °C
<b>Serial Number:</b> 34640050		<b>Humidity:</b> 21.0 %
<b>Description:</b> Multimeter		

<b>Procedure:</b> Fluke 287: (1 Year) ZCAL VER RS-232 /5520		<b>Revision:</b> 2.0
<b>Customer:</b> LIBERTY ELECTRIC		
<b>City:</b> CLACKAMAS		<b>Country:</b> US
<b>State:</b> OR		
<b>Purchase Order:</b> 1702		<b>RMA:</b> 31414912

This calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), radiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. Calibration certificates without signature are not valid. The calibration has been completed in accordance with Fluke Electronics Corporation Quality System Document 111.0 Revision 121 7/2017 and/or Fluke 17025 Quality Manual QSD 111.41 Revision 005 9/2014.

The Data Type found in this certificate must be interpreted as:

- As - Found Calibration data collected before the unit is adjusted and / or repaired.
- As - Left Calibration data collected after the unit has been adjusted and / or repaired.
- Found-Left Calibration data collected without any adjustment and / or repair performed.

This calibration conforms to the requirements of ANSI/NCSL Z540-1-1994 (R2002).

In the attached measurement results, deviation may be expressed with units, Measured Value (MV) - Nominal Value (NV) or as a proportion of the nominal value ((MV-NV)/NV), expressed without units with a scalar multiplier such as % (0.01), or as a ratio of the units (mA/A,  $\mu$ V/V, etc.) Descriptions such as  $\mu$ A/A,  $\mu$ V/V, and others, where used to annotate results or column headings are the preferred replacements for what was historically labeled as "ppm" or parts-per-million and

described the results in that column, unless otherwise noted by units symbols.

Where applicable, the expanded uncertainty of measurement at the time of test is given in the following pages. They are calculated in accordance with the method described in the ISO Guide to the Expression of Uncertainty in Measurement (GUM). The reported expanded uncertainty of measurement is stated as the

standard uncertainty of measurement multiplied by the coverage factor k, such that the confidence level approximates 95%.

Where applicable, the Test Uncertainty Ratio (TUR) is provided in the following pages. Unless otherwise stated, the TUR for a given measurement result is 4:1 or greater.

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications.

Measurement results greater than limits of error are indicated by '!'.



Z540-1:1994

Cert #: BVL406677  
 Cal Date: 15-Dec-2017  
 Due Date: 15-Dec-2018  
 S/N: 34640050

[www.fluke.com](http://www.fluke.com)

Cert #: BVL406677  
 Date: 15-Dec-2017  
 Due: 15-Dec-2018  
[www.fluke.com](http://www.fluke.com)



TRACY WRIGHT  
 Issued By

Certificate Number: BVL406677

Date of Calibration: 15-Dec-2017

**Standards Used**

<b>Asset</b>	<b>Description</b>	<b>Cal-Date</b>	<b>Cal-Due</b>
16533	Fluke 5522A Calibrator	06-Jul-2017	06-Jul-2018

**Calibration Data**

Parameter	Nominal Value	Measurement Result	Limits of Error		Test Uncertainty Ratio (TUR)
			Lower Limit	Upper Limit	
<b>Functional Tests</b>					
Power LED Test		Pass			
Backlight Test		Pass			
Current Sensing Test		Pass			
Keypad Test		Pass			
LCD Test		Pass			
IR Port Test		Pass			
<b>DC Voltage Tests</b>					
<b>50mV Range</b>					
0.000 mV	0.0000	0.000	-0.020	0.020	
0.025 mV	0.0250	0.025	0.005	0.045	
-0.025 mV	-0.0250	-0.025	-0.045	-0.005	
50.000 mV	50.0000	50.002	49.955	50.045	
<b>500mV Range</b>					
500.00 mV	500.000	500.00	499.85	500.15	
-250.00 mV	-250.000	-250.00	-250.08	-249.92	
<b>5V Range</b>					
4.0000 V	4.00000	4.0001	3.9988	4.0012	
<b>50V Range</b>					
-40.000 V	-40.0000	-40.001	-40.012	-39.988	
<b>500V Range</b>					
400.00 V	400.000	400.02	399.86	400.14	
<b>1000V Range</b>					
600.0 V	600.00	600.1	599.6	600.4	
<b>DC mV Tests DC/AC</b>					
50.00 mV	50.000	50.01	49.97	50.03	
<b>DC mV Tests AC/DC</b>					
250.00 mV @ 35 kHz	250.000	248.34	236.80	263.20	
<b>DC Voltage Tests DC/AC</b>					
0.2000 V	0.20000	0.2002	0.1977	0.2023	
<b>DC Voltage Tests AC/DC</b>					
2.0000 V @ 5 kHz	2.00000	2.0052	1.9640	2.0360	

**Calibration Data**

Parameter	Nominal Value	Measurement Result	Limits of Error		Test Uncertainty Ratio (TUR)
			Lower Limit	Upper Limit	
<b>AC Voltage Tests</b>					
<b>50mV Range</b>					
5.000 mV @ 20 Hz	5.0000	4.998	4.865	5.135	
50.000 mV @ 65 kHz	50.0000	49.032	48.210	51.790	
<b>500mV Range</b>					
50.00 mV @ 100 kHz	50.000	49.39	47.85	52.15	
250.00 mV @ 65 kHz	250.000	248.48	240.85	259.15	
500.00 mV @ 45 Hz	500.000	499.87	498.25	501.75	
<b>5V Range</b>					
0.1000 V @ 60 Hz	0.10000	0.1020	0.0952	0.1048	
0.5000 V @ 10 kHz	0.50000	0.4982	0.4945	0.5055	
3.0000 V @ 100 kHz	3.00000	2.9940	2.8160	3.1840	
<b>50V Range</b>					
15.000 V @ 100 kHz	15.0000	14.980	14.435	15.565	
<b>500V Range</b>					
500.00 V @ 10 kHz	500.000	499.73	497.75	502.25	
<b>1000V Range</b>					
1000.0 V @ 10 kHz	1000.00	999.3	993.5	1006.5	
<b>Frequency</b>					
45.000 Hz @ 500.0 mV	45.0000	45.000	44.986	45.014	
950.00 kHz @ 600.0 mV	950.000	950.00	949.90	950.10	
<b>Duty Cycle</b>					
15.00 % @ 50 kHz	15.000	22.92	4.90	25.10	
<b>AC Voltage Peak Test</b>					
2.000 Vp @ 2 kHz	2.0000	1.998	1.863	2.137	
<b>Capacitance Tests - 10nF Range</b>					
5.00 nF	5.000	5.00	4.90	5.10	
<b>Diode Test</b>					
3.1000 V	3.10000	2.8160	2.0000	3.1000	
<b>Resistance Tests</b>					
<b>500 Ohm Range</b>					

**Calibration Data**

Parameter	Nominal Value	Measurement Result	Limits of Error		Test Uncertainty Ratio (TUR)
			Lower Limit	Upper Limit	
0.00 Ohm	0.000	0.00	-0.10	0.10	
0.20 Ohm	0.200	0.20	0.10	0.30	
500.00 Ohm	500.000	499.96	499.65	500.35	
<b>5 kOhm Range</b>					
5.0000 kOhm	5.00000	5.0005	4.9973	5.0027	
<b>50 kOhm Range</b>					
50.000 kOhm	50.0000	50.004	49.973	50.027	
<b>500 kOhm Range</b>					
500.00 kOhm	500.000	500.00	499.73	500.27	
<b>5 MOhm Range</b>					
5.0000 MOhm	5.00000	5.0009	4.9921	5.0079	
<b>30 MOhm Range</b>					
30.000 MOhm	30.0000	30.032	29.546	30.454	
<b>500 MOhm Range</b>					
300.0 MOhm	300.00	303.1	275.8	324.2	
<b>DC Current Tests</b>					
<b>500uA Range</b>					
500.00 µA	500.000	500.02	499.42	500.58	
<b>5000uA Range</b>					
5000.0 µA	5000.00	5000.0	4996.0	5004.0	
<b>50mA Range</b>					
0.100 mA	0.1000	0.101	0.090	0.110	
50.000 mA	50.0000	49.992	49.965	50.035	
<b>400mA Range</b>					
400.00 mA	400.000	399.89	399.38	400.62	
<b>5A Range</b>					
5.0000 A	5.00000	5.0001	4.9840	5.0160	
<b>10A Range</b>					
10.000 A	10.0000	10.001	9.968	10.032	
<b>AC Current Tests</b>					
<b>500uA Range</b>					
500.00 µA @ 60 Hz	500.000	499.71	496.80	503.20	
500.00 µA @ 30 kHz	500.000	498.53	492.85	507.15	1.28

**Calibration Data**

Parameter	Nominal Value	Measurement Result	Limits of Error		Test Uncertainty Ratio (TUR)
			Lower Limit	Upper Limit	
<b>5000uA Range</b>					
5000.0 µA @ 30 kHz	5000.00	5002.2	4928.5	5071.5	2.98
<b>50mA Range</b>					
4.000 mA @ 20 Hz	4.0000	3.991	3.940	4.060	
30.000 mA @ 30 kHz	30.0000	29.970	29.375	30.625	
<b>400mA Range</b>					
300.00 mA @ 30 kHz	300.000	300.85	284.60	315.40	
400.00 mA @ 60 Hz	400.000	400.01	397.55	402.45	
<b>5A Range</b>					
5.0000 A @ 1 kHz	5.00000	5.0002	4.9580	5.0420	
<b>10A Range</b>					
5.000 A @ 1 kHz	5.0000	5.006	4.955	5.045	

**Temperature Test**

**Type-K Thermocouple**

Temperature simulated by voltage.

0.0 °C	0.00	0.0	-1.0	1.0
100.0 °C	100.00	99.9	98.0	102.0
1000.0 °C	1000.00	1000.1	989.0	1011.0